

Armed Forces Epidemiological Board

PAVE PAWS Health Assessment

INFORMATION BRIEF
Update



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Director Military Public Health
22 March 2005



PAVE PAWS

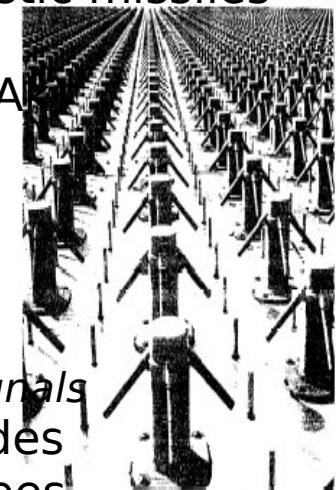
Background

- **System**

- **PAVE** - Air Force program name; **PAWS** - Phased Array Warning System
- Detect and track sea-launched and intercontinental ballistic missiles
- Earth-orbiting satellite detection and tracking
- AF Space Command - Cape Cod (Ma), Beale (Ca), Clear (Al)

- **Features**

- Phased array antenna technology
 - Antenna is a fixed position
 - Aiming (beam steering) is done rapidly by electronically controlling the timing, or phase, of the incoming/outgoing signals
- Radar is housed in a 105-foot high building with three sides
- The two array faces: 102 ft wide and tilted back 20 degrees
 - Each array contains 5,354 elements - 2,677 inactive and 1,792 active
- 420-450 MHz



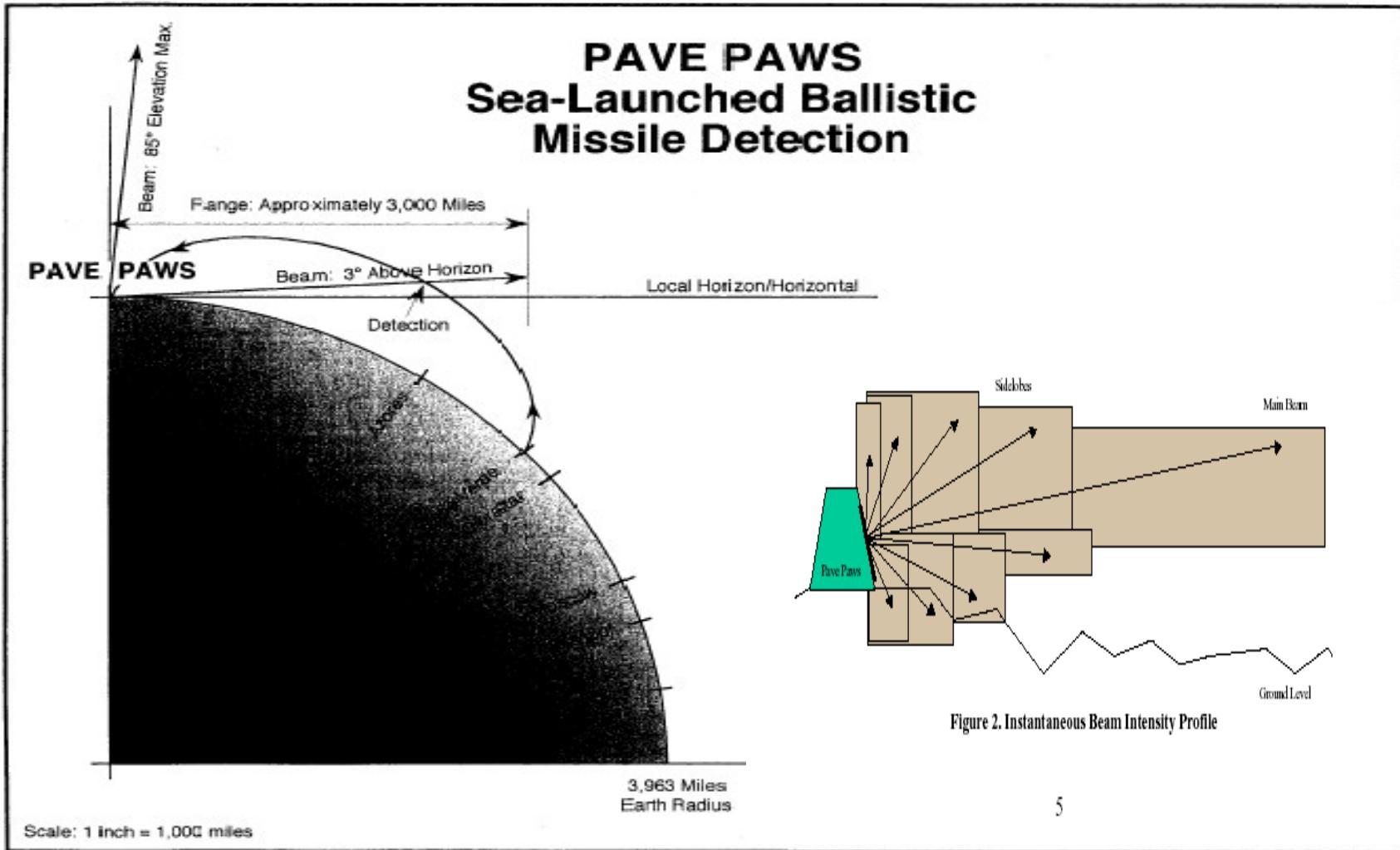
- **History**

- PAVE PAWS Installation, first of its type in 1978 - activation 1979



PAVE PAWS

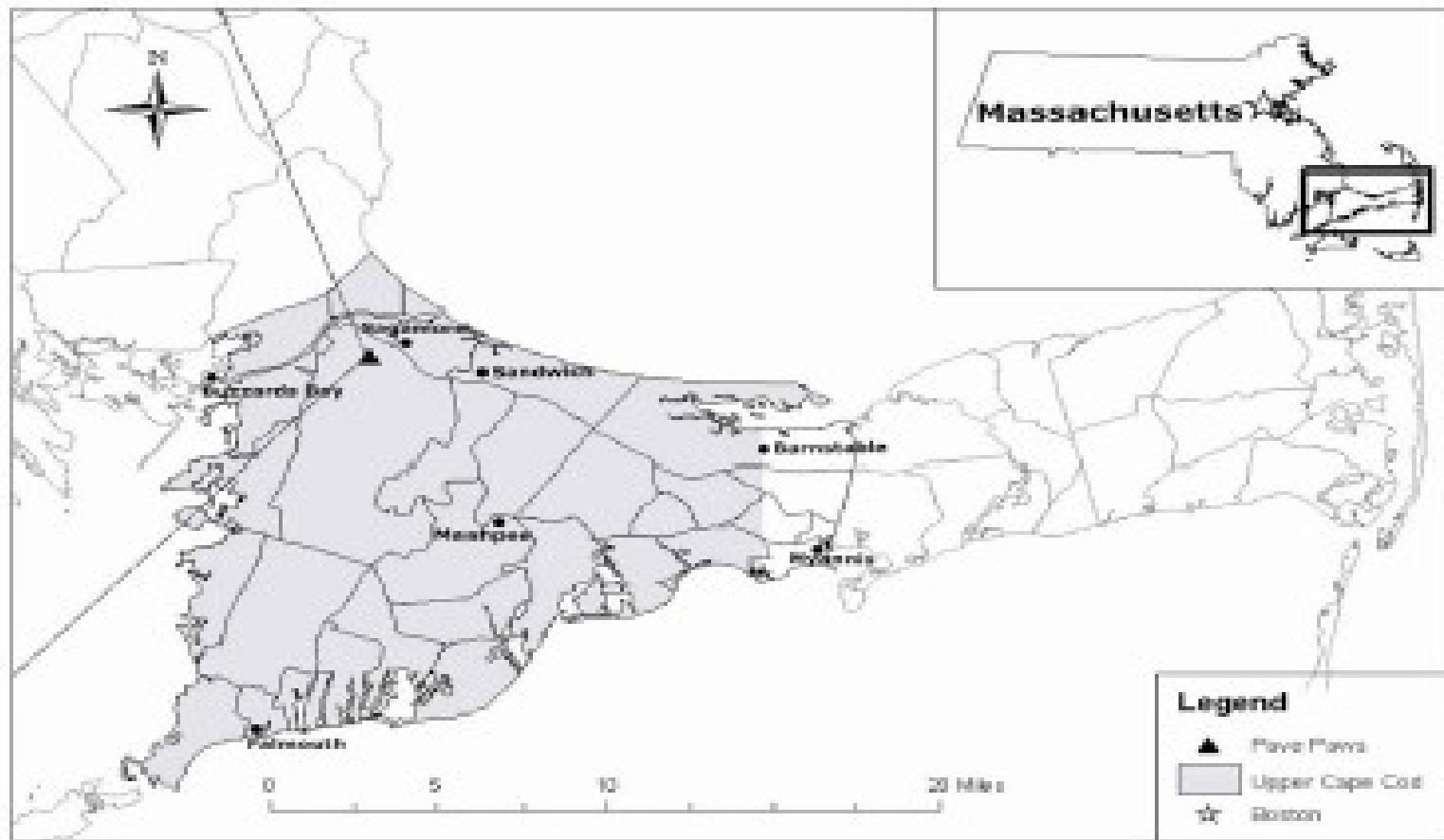
Graphic Display





PAVE PAWS

Graphic Display



Map of Cape Cod



Electromagnetic Spectrum

Emitter Locations

Emitter	Electromagnetic Spectrum
AM radio	0.535-1.605 MHz
FM radio	88-108 MHz
Low VHF TV (Channels 2-6)	4-88 MHz
High VHF TV (Channels 7-13)	174-216 MHz
PAVE PAWS	420-450 MHz
UHF TV (Channels 14-83)	470-890 MHz
Wireless communications base stations	820-890 MHz and 1850-2000 MHz
Civilian/military radars (boat, airport radar) & microwave point to point radio	above 2000 MHz



PAVE PAWS

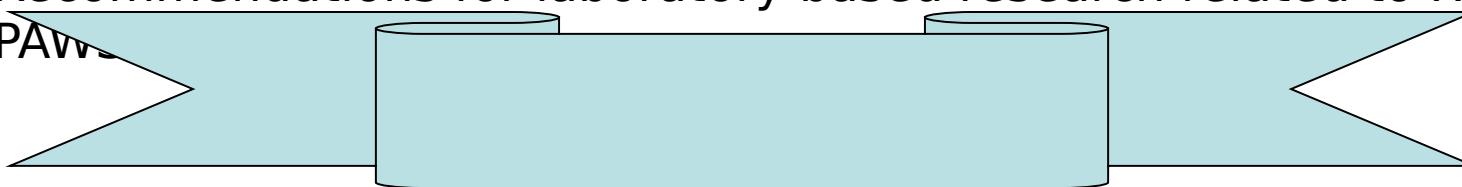
Health Concerns

- **1978**

- Cape Codders object to the radar on the basis of the threat to public health by exposure to radiofrequency radiation emitted by the radar.

- **1979**

- National Research Council... "PAVE PAWS radar... low intensities of pulse-modulated microwave fields... There are no known irreversible effects of such exposure on either morbidity or mortality..."
- Recommendations for laboratory based research related to PAVE PAWS





PAVE PAWS

Exposure Levels

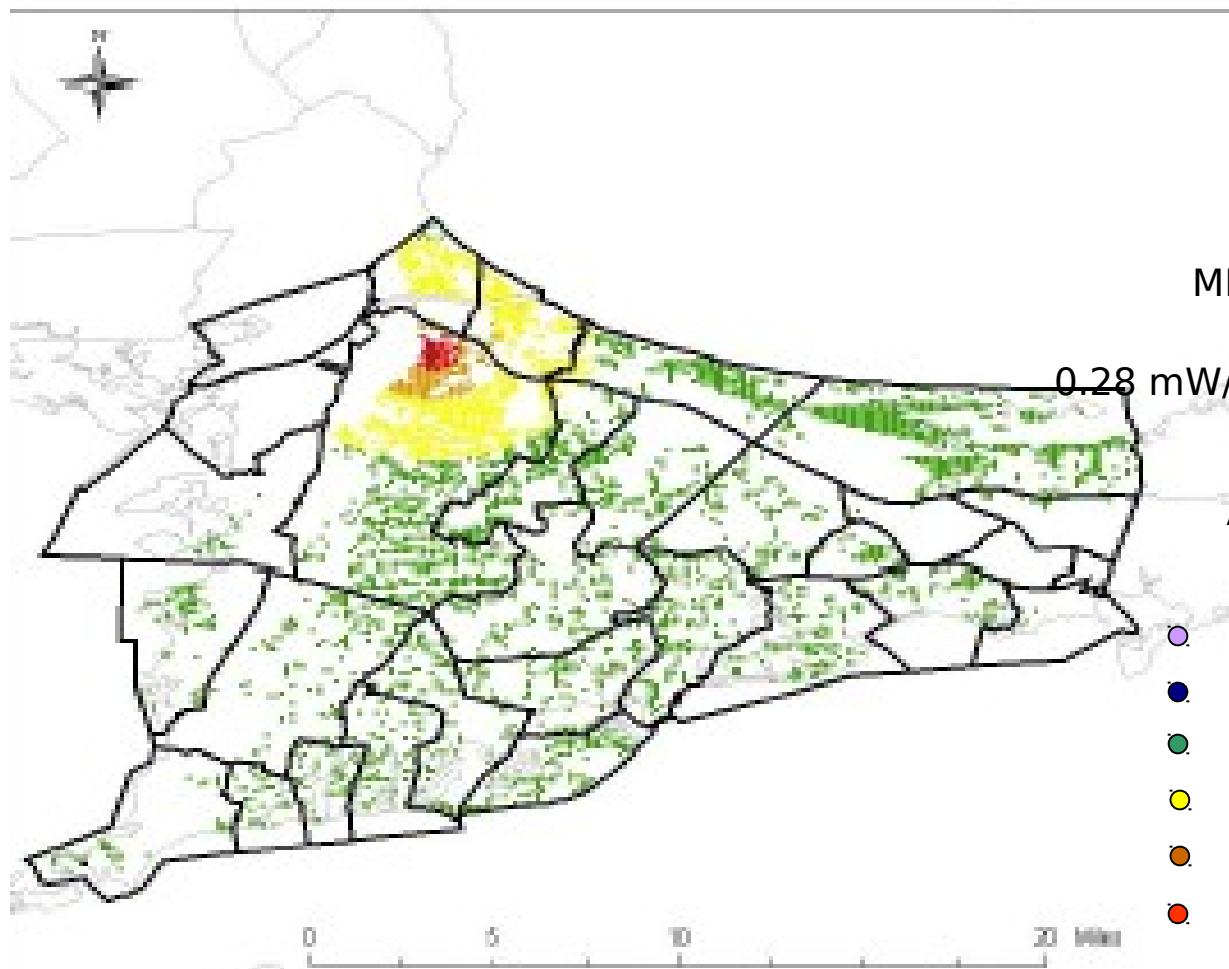
- RF Human maximum permissible exposures (MPEs) are expressed in terms of maximum allowable incident power densities
 - $\mu\text{W}/\text{cm}^2$ microwatts per square centimeter, Milliwatts per square centimeter (mW/cm^2) or watts per square meter (W/m^2)
 - MPE @ 450 MHz (PAVE PAWS) is $0.28 \text{ mW}/\text{cm}^2$
- Modeled & measured exposure levels at 5,000 - +20,000 lower than MPE
- MPEs are selected on the basis of the highest values of "specific absorption rate" (SAR) found not to be harmful in animal studies
 - SAR is expressed in watts per kilogram (W/kg) or milliwatts per gram (mW/g)



PAVE PAWS

Graphic Display

Simple Average power density ($\mu\text{W}/\text{cm}^2$)



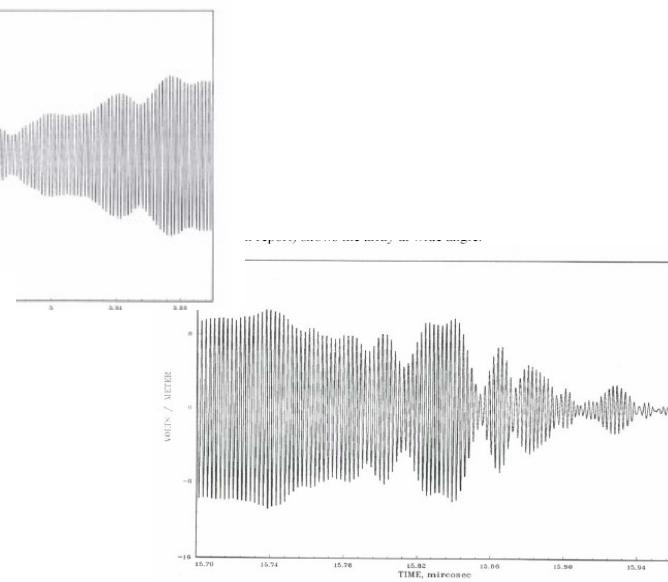
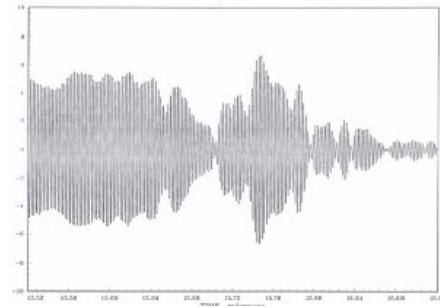
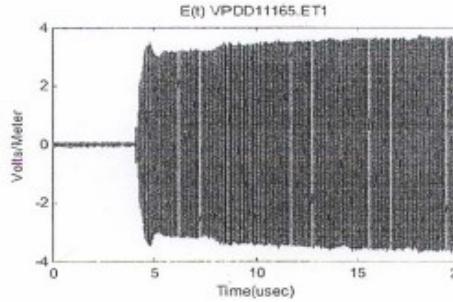


PAVE PAWS

Health Concerns

- **1998**

- Cape Codders concerned that PAVE PAWS “unique” exposure is such that existing safety measures do not adequately protect the public and is contributing to adverse health on Cape Cod
- The possible implications for health arising from the propagation of the RF energy in tissue.
- Classified AF research





PAVE PAWS

Cape Cod Health Considerations

- Premature Mortality - (Death before age 75)
 - State Average 347 per 100,000
 - All towns except Bourne (388/100,000) below state Average
- Cancer
 - Apparent elevations in cancer incidence for certain cancers
 - Lung and leukemia - Falmouth & Bourne
 - Excess of cancer of Breast, colon and rectum, and lung
 - Variable increases for cancer of the pancreas, kidney and bladder
- Birth defects - Southeastern Mass (Includes Cape) is State lowest
- Confounding Factors
 - Many known or suspected environmental hazards affecting Cape Cod
 - 15% of Barnstable county working population commute off cape
 - Barnstable County lead Mass counties with highest



PAVE PAWS

Community concerns

PAVE PAWS (Oct. 1, 2000)

PAVE PAWS re-enters the limelight (Sept. 21, 1999)

Kennedy seeks new research on radar (Jan. 13, 2001)

PAVE PAWS study planned (Dec. 14, 1999)

Air Force trip for officials defended (Jan. 11, 2001)

Sandwich radar site clearly on her screen (Jan. 16, 2000)

Residents express concern on radar (Jan. 23, 2000)

PAVE PAWS opponents will be independently (Dec. 30, 1999)

Radar facility focus of activists (Nov. 27, 1999)

Critics unhappy with PAVE PAWS study (Nov. 30, 1999)

Residents challenge role of Air Force radar group (Mar. 27, 2000)

Experts doubt radar's safety (Dec. 27, 2000)

Cape activists allege conflict in radar study (Mar. 4, 2000)

PAVE PAWS (Feb. 21, 1999)



PAVE PAWS

Community concerns

PAVE PAWS talks to give public a say (Apr. 24, 2000)

Boston group cites PAVE PAWS as hazard (Nov. 29, 2000)

Sandwich woman lobbies for full PAVE PAWS review (Nov. 6, 1999)

Cape residents question plan for PAVE PAWS upgrade (Sep. 22, 1999)

Public blasts state's PAVE PAWS report (Mar. 14, 2000)

Air Force promotes PAVE PAWS upgrade (Mar. 29, 2000)

PAVE PAWS to be discussed (Mar. 13, 2000)

New forum to air fears over radar (Feb. 17, 2000)

Radar critic urges study of health risks (Mar. 14, 2001)

Air Force counters radar health worries (Apr. 27, 2001)

Radar facility faces review (Nov. 30, 1998)

Cape's lawmakers urge radar study (Apr. 11, 2001)

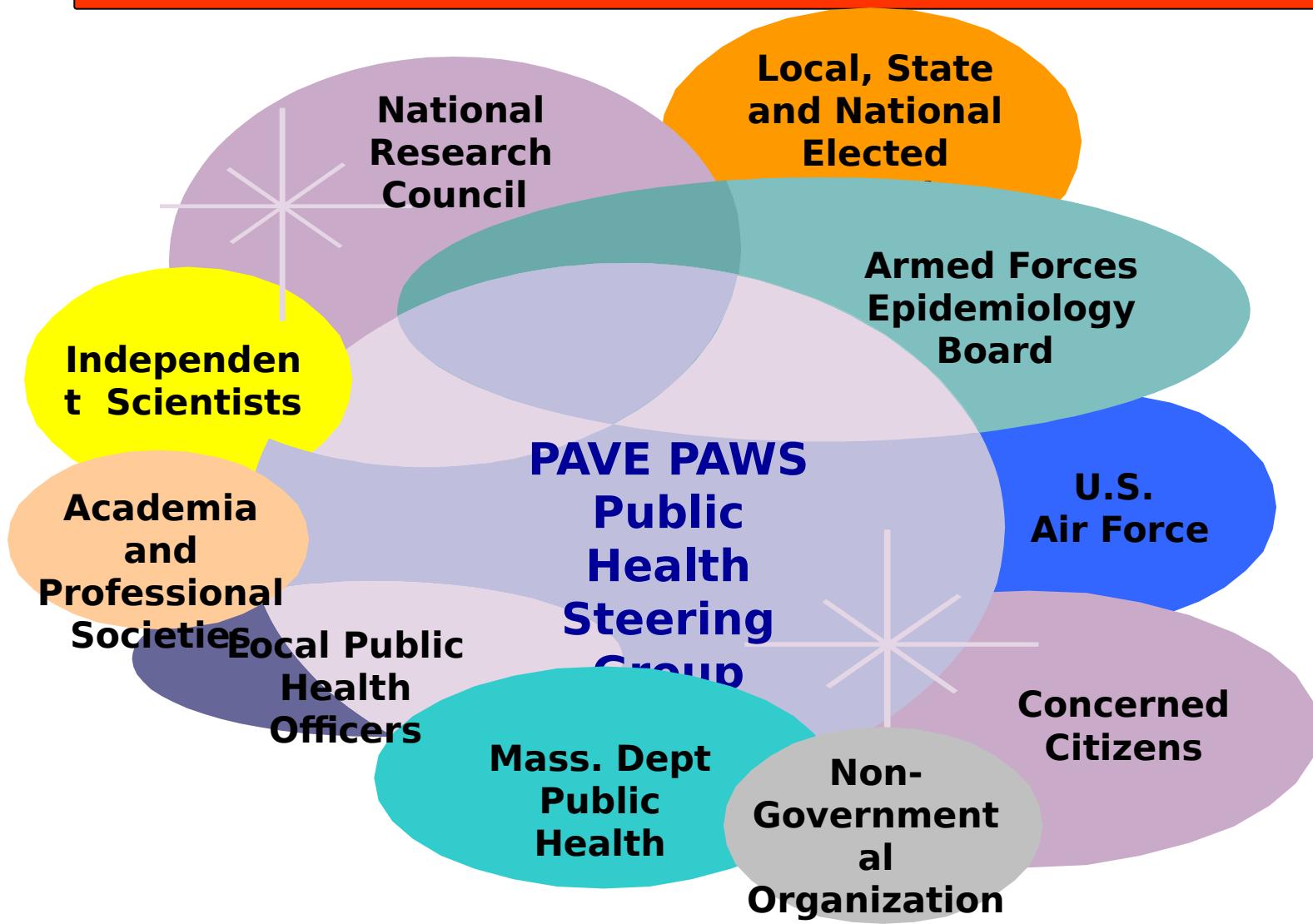
County may oversee study of PAVE PAWS (Aug. 3, 2000)

PAVE PAWS modernization debated (Aug. 18, 2000)



PAVE PAWS

Community Approach





PAVE PAWS

Health Concerns

- **1999**
 - MDPH Independent Scientific Panel... “there is no definitive scientific evidence to claim that the anticipated low radio frequency radiation (RFR) levels from PAVE PAWS could cause any harmful effect to the public”
- **2002**
 - AFEB... “no evidence to suggest a cause and effect relationship between... elevated standardized rate ratios of disease... and the PAVE PAWS Radar”
- **2005**
 - NRC... “there is no evidence of adverse health effects to Cape Cod residents from long-term exposure to radiofrequency energy from PAVE PAWS”



PAVE PAWS

Summary of NRC Conclusions

- **Focused on the scientific evidence and carefully evaluated all the scientific evidence available to determine whether there is a reasonable degree of certainty regarding the presence or absence of harm from exposure to the PAVE PAWS phased-array radar.**
 - "... there are no adverse health effects to the population resulting from continuing or long-term exposure to the PAVE PAWS radiation"
 - "... there is no increase in total cancers or cancers of the prostate, breast, lung, or colon due to exposure to the PAVE PAWS radiation."
 - "... the committee has not found evidence of a mechanism shown to change biologic processes at power levels that are associated with the recent waveform-characterization data collected for the PAVE PAWS radar..."
- **"... the "precautionary principle" which seeks to avoid taking actions that might have the potential for harm unless a relative degree of safety can be assured... are policy or management decisions and not solely a matter of science"**



PAVE PAWS

Summary of NRC Recommendations

- “...Given the lack of supportive data to propose specific hypothesis to be tested the spectrum of health-related effects within context of PAVE PAWS is almost limitless...” (NRC)
- “... future health investigations or epidemiologic studies should look at exposures at both the census-tract and census-block level, and try to better estimate personal exposure and consider the types of factors known to complicate human health investigations”
- “Future or ongoing health studies should also specifically address possible early age-of-exposure and/or early age-at-onset of an adverse health effect”
- “Finally, future epidemiologic studies should not be conducted unless they are expected to have sufficient statistical ability, or so-called power, to be able to detect any possible health effects in the Cape Cod population”



PAVE PAWS

Not Finished Yet

